Memo

To: Fishteam Members
From: Bruce Herbold
Date: [Date]
Subject: Evaluation of effects of operational changes in EWA gaming

INTENT: As we proceed with the EWA gaming exercise, it will be essential that we translate changes in hydrology into a measure of protection provided to the fish. This memo builds on the structure of my previous (March 10, 1999) memo. It is a restatement of steps three and seven in light of the meetings, emails, and conversations of the last week. As before, I do not expect anyone to accept these evaluation criteria as 'correct,' I am only trying to provide evaluation criteria that will permit relative comparisons of different scenarios

These evaluation criteria can be used to assess how regulatory or EWA changes to hydrology could be expected to change historical fish impacts. Because the entrainment data are the basis of the gaming exercise I attempt to quantify how changes in pumping and flow patterns could be expected to change fish entrainment. All parties have stated that the less quantifiable impacts on system productivity are probably more important at the population level.

EFFECTS OF OPERATIONAL CHANGES ON HISTORIC DATA

Step 1. For all species a change in pumping rates is expected to have a proportional change in numbers entrained. Thus, given an historical pumping rate and an historical salvage rate the first-step toward assessing impacts is to change the salvage in direct proportion to the change in pumping rate.

Step 2. For many species there are expected changes in response to hydrological conditions that would be expected to change their densities at the export facilities.

The hydrological changes that alter densities at the export facilities are different for each species.

Delta smelt

For delta smelt, both adults and young in most months of the year, movement of X2 downstream can be expected to reduce the density. If X2 is already downstream of Chipps Island (km 74) this effect is probably negligible. However, as an evaluation criterion, a reduction in density by 10% for each westward km of X2 is probably the best we can estimate today.

For delta smelt young in the months of April and May, closure of the barrier at the head of Old River is expected to increase entrainment. Without the barrier in place about 60% of the San Joaquin flow goes directly to the export facilities. If export rates are unchanged and the barrier is in place this volume of water is then drawn from the central delta, presumably with a greater risk of entraining young smelt. Therefore, entrainment effects could be equivalent to exporting an additional volume of water equal to 60% of the San Joaquin flow.

For delta smelt, closure of the Delta Cross Channel is likely to have both positive and negative effects on entrainment depending on the timing and location of spawning. For purposes of the game I would propose that no net impact be assessed of the DCC on delta smelt.

Sacramento salmon smolts and yearlings

Closure of the DCC prevents many smolts from entering the interior delta and greatly reduces both the risk of indirect mortality and the risk of entrainment at the facilities. At present the original estimate of a 50% reduction in entrainment is probably good enough for the game. However, the historical data of smolt entrainment is probably dominated (90-95%) by San Joaquin smolts.

San Joaquin smolts

In my original memo I proposed some evaluation criteria for QWEST. For VAMP I proposed a patently unclear measure of "2* proportionality."

Discussions with several parties last week leads me to propose splitting QWEST and VAMP into their two principle components: exports and San Joaquin flow rate. Exports we already use a straight proportionality. Increases in flow on the San Joaquin could have a similar proportional reduction in density per acre-foot of San Joaquin smolts. Thus, both VAMP and QWEST could be evaluated by reducing densities by the proportional change in San Joaquin flow and multiplying that by the new export rates to get a corrected measure of entrainment effects relative to historical.

Closure of the barrier at the head of Old River (HOR) has effects that are probably inseparable from export rates. At low exports Jim White has suggested that the

benefits of HOR may be 80 to 90% reductions in historical entrainment. However, at high entrainment Jim suggests that the benefit may drop to as low as 20-30% because of the risk of entraining San Joaquin smolts as they pass through the central delta. As a very simple approximation I propose that the benefit of HOR be a percent reduction in historical salvage by (10000-export)/100. Thus, if exports are 8000, the benefits of HOR are a reduction of 20% whereas if exports are 2000 the benefits of HOR are 80%.

Striped bass eggs and larvae

Two factors that would reduce the densities of striped bass eggs and larvae in the south delta would be San Joaquin river flows and the DCC. DCC closure might reduce interior delta densities of Sacramento River spawned bass by about 50%. However, the Accord is expected to increase the incidence of spawning in the lower San Joaquin so that future entrainment might be less affected by DCC operation. As an interim estimate I suggest that DCC operation reduces striped bass E&L entrainment by 25%.

Increases of San Joaquin River flows should both reduce the density of eggs and larvae by dilution but flow should also reduce densities in the south delta by assisting transport of those lifestages downstream. Straight proportionality seems to be a conservative estimate.

Since the salvage data do not include E&L data these calculations are unlikely to affect the game results.

Step 3. Some of the changes in densities are cumulative and some are not. Some pairs of possible effects could be expected to have synergistic or contradictory.

As a general rule I propose that barrier results and flow results are cumulative but that for any one species there is only one flow variable that is expected to alter density.

Step 4. Effects on broader changes in hydrology on individual species would be reflected in different hydrological conditions.

For several species there are environmental variables that are expected to improve general ecological conditions in ways that are separate from entrainment results. For delta smelt this measure is probably the number of days when X2 is in Suisun Bay. For salmon from either river this is probably best reflected in QWEST, with a much greater impact on Sacramento stocks if the DCC is open. For striped bass larvae this general ecological condition is probably best summarized by X2

location. In all these variables we should avoid suggesting the mechanism and rely on the simple correlations as the basis for assessing importance.

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